DOCUMENT RESUME

ED 214 954 TM 820 103

AUTHOR de Porcel, Antonio; And Others
TITLE Studies in Bilingual Evaluation, Work Unit I: Bilingual Prediction Project. Final Report.
INSTITUTION California Univ., Los Angeles. Center for the Study of Evaluation.
SPONS AGENCY National Inst. of Education (DHEW), Washington, D.C.
PUB DATE Nov 79
GRANT OB-NIE-G-78-0213
NOTE 75p.

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS *Bilingual Students; Elementary Education; Expectancy Tables; *Language Proficiency; *Models; *Monolingualism; Predictive Measurement; *Predictive Validity; Predictor Variables; Regression (Statistics); *Test Construction
IDENTIFIERS *Bilingual Prediction Project

ABSTRACT

The final report of the Bilingual Prediction Project presents a review of the project from its inception in 1975 through completion in 1979. The main goal was to predict a student's academic ability in English. A prediction index was constructed in two stages. The first stage was a description of the target population and their school setting, as well as isolation of the variables most strongly associated with success in the monolingual program. Techniques and instruments to identify and measure variables associated with success were developed and tested. The second chapter of the report includes a description of the conception and development of the prediction model. Several attempts were made to develop a model using expectancy tables and regression analysis. The small sample size of the target population was a severe limitation for the use of these procedures. The third chapter is theoretical and deals with problems of validating indices constructed through the prediction model. The validation models which can be used include a correlation analysis, an analysis of variance, and a trait-treatment analysis. These are described in detail. The final chapter is the same as the limitations section in the User's Manual. (DWH)

**********
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
**********

ED214954

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
This document has been reproduced as received from the person or organization originating it.
Minor changes have been made to improve reproduction quality.
Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

DELIVERABLE: November 1979

# STUDIES IN BILINGUAL EVALUATION

Work Unit: 1

## Bilingual Prediction Project

Antonio de Porcel
Project Director

## FINAL REPORT

Antonio de Porcel
Frank Capell
Ebrahim Maddahian
Beverly Cabello

Grant Number

OB-NIE-G-78-0213

Center for the Study of Evaluation
Graduate School of Education
University of California, Los Angeles

Tm 820 103

The work upon which this publication is based was performed pursuant to a grant with the National Institute of Education, Deparment of Health, Education and Welfare. Points of view or opinions stated do not necessarily represent official NIE position or policy.

ACKNOWLEDGMENTS

We wish to thank Dr. Leigh Burstein for his useful and creative suggestions in the development of the prediction model.

We appreciate the patient and thorough review of this document by Linda Polin, Betty Shumener, and Lynn Winters.

We offer our deepest gratitude to the teachers and students of those schools in California and Massachusetts who have partipated in the project. The Bilingual Prediction Project could not have been successful without the consent and cooperation of the school administrators, teachers, parents, and students in these schools.

We are also indebted to those persons who assisted us in the collection, processing, and analysis of the data for the studies. We would like to commend Mary Sparta for her assistance as secretary of the project.

We would like to acknowledge the support and valuable suggestions of Dr. Eva Baker and Dr. Adrianne Bank.

Finally, we also want to mention the contribution of persons who were in charge of the Bilingual Prediction Project in previous years: Dr. Ricardo Cornejo (1975/1976); Dr. Lee Trithart (1976); and Dr. Kathleen Fisher (1977/1978).

TABLE OF CONTENTS


| | Page |
|---|---|
| LIST OF TABLES AND FIGURES | iii |
| INTRODUCTION | 1 |
| The Prediction Index | 1 |
| Interpretation of the Prediction Index | 2 |
| Overview of the Prediction Index | 4 |
| Overview of the Final Report | 5 |
| CHAPTER ONE: A BRIEF HISTORY OF THE BILINGUAL PREDICTION PROJECT | 7 |
| Stage 1: Identification of target population | 8 |
| Stage 2: Instrument selection | 9 |
| Pilot Study | 10 |
| Results of the Pilot Study | 15 |
| Conclusions: Pilot Study | 33 |
| The Follow-Up Study | 34 |
| The Extended Sample Study 1977-1978 | 35 |
| Results of the Extended Sample Study | 38 |
| General Conclusions from the Pilot and Extended Sample Studies. | 41 |
| CHAPTER TWO: PROCEDURES FOR CONSTRUCTING PREDICTION INDICES | 44 |
| Use of Expectancy Tables of pairs of variables | 45 |
| Use of a simple regression procedure | 46 |
| Use of regression residuals | 48 |
| CHAPTER THREE: VALIDATION OF PREDICTION INDICES. | 53 |
| Correlation Model | 53 |
| Factoral ANOVA Model | 55 |
| The Trait-Treatment Analysis Model | 57 |
| CHAPTER FOUR: LIMITATIONS ON THE USE OF PREDICTION INDEX | 60 |
| Interpretation | 60 |
| Assumptions | 61 |
| Instruments | 64 |
| Assignment | 64 |
| Limitations on the construction of the indices | 64 |
| BIBLIOGRAPHY. | 66 |

## LIST OF TABLES AND FIGURES


| Table | | Page(s) |
|---|---|---|
| 1 | Measurement Instruments Listed in the 1975 Proposal | 10 |
| 2 | List of Instruments Used in the Pilot Study | 14/15 |
| 3 | Language, attitudinal, demographic, and instructional variables: correlation matrix | 17 |
| 4 | SOBAR: Pilot Study: English Reading | 18 |
| 5 | Summary of Predictions | 19 |
| 6 | ECE: Pilot Study: English Reading | 21 |
| 7 | Summary of Predictions | 22 |
| 8 | Summary table of multiple step-wise regression analysis, using ECE | 23 |
| 9 | Example of Prediction Index | 24 |
| 10 | Summary of Predictions | 25 |
| 11 | Summary Table of multiple step-wise regression analysis for CTBS. | 26 |
| 12 | Pearson Moment Correlations Between Attitude Measures and English Reading | 20 |
| 13 | Variables Included in Factor Analysis: Names and Descriptions | 28 |
| 14 | Varimax Rotated Factor Matrix | 29 |
| 15 | Eigenvalues and Proportion of Variance of Six Major Factors | 29 |
| 16 | The Six Factors | 30 |
| 17 | Measures of English Reading Proficiency: Intercorrelations | 33 |
| 18 | Test Batteries Used in the Extended Sample Study | 37 |
| 19 | Battery I. | 40 |
| 20 | Battery II | 40 |

FIGURE

| | | |
|---|---|---|
| 1 | Illustration of the Use of Regression Residuals in the Construction of Prediction Indices | 51 |
| 2 | Example of Factorial Design (2X2) Which Could Be Used for the Validation of Prediction Indices | 56 |
| 3 | Design That Could Be Used for the Validation of Prediction Indices. | 59 |

# INTRODUCTION

The Bilingual Prediction Project was initiated in 1976 to develop a practical method for making decisions about the transition of students from bilingual to monolingual English programs. The project was funded by the National Institute of Education and implemented by the Center for the Study of Evaluation at the University of California, Los Angeles.

The goal of the Bilingual Prediction Project was to produce a decision making model that would aide schools in transferring students from bilingual to monolingual programs. The final product of the project is a User's Manual which describes the decision-making model, the prediction index. Two studies, a Pilot Study, conducted in 1976-77, and an Extended Sample Study, conducted in 1977-78, provided student achievement data for testing the prediction index model. The sample indices obtained in these studies, as well as the procedures for constructing prediction indices and guidelines for their interpretation are included in the User's Manual.

## The Prediction Index

The transition decisions commonly made in schools generally rely upon two basic assumptions: First, that the students to be transitioned are going to be able to respond successfully to the demands of the new instructional environment. Second, that the new instructional environment is going to provide educational opportunities which are adequately suited to the educational needs of these students. Consequently, a transition decision can be seriously questioned if either one of these two assumptions is incorrect.

We based the prediction model for the Bilingual Prediction Project upon the first of these assumptions: transitional students must be able to meet the demands of the monolingual curriculum. The prediction index itself consists of four components: a core variable, a reference group, a set of supplementary variables, and a set of prediction groups. Our model compares the bilingual student's achievement in certain curricular areas with the achievement of average students enrolled in monolingual English programs. Because the comparison involves several aspects of the curriculum, more than one prediction index is required. In fact, indices may be calculated for the entire core part of the monolingual curriculum. The predictions, then, are made with reference to the performance of the students attending a monolingual English program, that, is, the future classmates of the transitioned students.

Interpretation of the Prediction Index

Predictions made by the indices assume that success in the bilingual program relates directly to the monolingual English program. In other words, good candidates for transition are those students performing as successfully in the bilingual program as their potential peers in the monolingual English program.

The extent to which this transferability of success really occurs is an empirical question. It is likely to depend upon similarities and differences of the two programs. Since a phenomenological description of the constitutents of school success is not yet available, the value and usefulness of the predictions needs to be empirically validated. For this reason,

prediction indices are not to be used as a substitute for the exit criteria commonly used in schools at the present time. On the contrary, prediction indices should be used as devices to complement and increase the strength of transition decisions based upon exit criteria.

There are several factors, other than the student's ability to academically respond to the instructional demands of the monolingual English program, which are likely to affect his/her performance in the monolingual English program. Most of these factors are not taken into account in the construction of prediction indices. Nevertheless, these factors do affect a student's chances for success in the monolingual English program. Some of the factors are:

* the desire and/or the motivation of the transitioned student to achieve as much as his/her peers in the monolingual English program;
* the adaptability of the transitioned student to the socio-cultural environmental characteristics of the monolingual English program;
* the specific attitudes of the transitioned student towards the different salient aspects of the monolingual English program;
* the ability of the transitioned student to obtain from the teacher the amount of attention he/she requires to meet the demands of the monolingual English program;
* the ability of the transitioned student to change and/or ignore the negative attitudes that could exist towards him/her and his/her cultural background within the climate of the monolingual English program.

Consequently, it is necessary to distinguish between two types of

predictions that can be made regarding the transition of students in bilingual programs. The first type of prediction deals directly with the problem of the student's ability to respond to the academic demands of the monolingual English program. This prediction deals with the student's readiness to profit from instruction given solely in English across the different curriculum areas. It is based on the assumption that the only difference between bilingual and monolingual English programs is the language of instruction.

The second type of prediction deals with attitudinal, motivational, affective, and socio-cultural factors. Each of these factors is also necessary for successful transition. At the present time, however, the construction of indices to make these predictions is questionnable due to the difficulties of measuring these variables appropriately. Furthermore, it is not clear whether these variables exist in the repertoire of the students to be transitioned. For example, it seems impossible to assess a student's readiness to adapt to the socio-cultural environment of the monolingual English program before this student is actually placed in such an environment.

The Bilingual Prediction Project has provided indices to make only the first type of predictions. The resulting prediction model, however, can be applied to the construction of indices to predict these other factors, provided, of course, that the difficulties mentioned above are resolved.

## Overview of the Prediction Procedure

Predictions made by indices constructed according to the model resulting from the Bilingual Prediction Project are made in two stages. The first

stage is based entirely on a direct comparison of the students in the monolingual English program. This is done through the comparison of the bilingual student's standard scores on the core variable of the index to the average performance and the standard deviation of the reference group. As a result of this first prediction, students are clustered in the three prediction groups: the transfer, the undecided, and the no-transfer groups.

The second stage draws on the contributions made by supplementary variables and relates these to the core variable. In this stage, only students who were assigned to the undecided group are considered. This is done through the use of standardized regression residuals computed from a regression between each supplementary variable and the core variable. Data for this regression analysis are obtained from the students in the bilingual program.

In both the first and second stages, a set of prediction rules is used to assign students to these prediction groups. These rules are derived from cut points selected on the following bases: 1) the student's position on the core variable, relative to the reference group in the monolingual English program, and 2) the student's position on the regression line, relative to the students in the bilingual program.

Overview of the Final Report

This final report is made up of four chapters. The first chapter presents a brief review of the Bilingual Prediction Project from its inception in 1975, including the original proposal, to the present. This review is a summary of the important events which have shaped the project during its implementation.

The second chapter includes a brief description of the steps by which the prediction model was conceived and developed. It contains a description of various attemps made to develop a model using Expectancy Tables and Regression Analysis.

The third chapter deals with the problem of validating the indices constructed through the prediction model. The content of this chapter is rather theoretical. It represents our thinking regarding the alternative ways in which prediction indices can be validated. It also briefly attempts to apply one of these models to the validation of a sample indices presented in the User's Manual.

The fourth and final chapter describes some of the limitations of the prediction model and of the indices constructed using this model. The content of this chapter is the same as the limitations section included in the User's Manual.

# CHAPTER ONE

## A BRIEF HISTORY OF THE BILINGUAL PREDICTION PROJECT

The Bilingual Prediction Project was proposed to the National Institute of Education in 1975. The proposal submitted by the Center for the Study of Evaluation at the University of California, Los Angeles, states that the purpose of the project was:

> "...to develop an index which will predict with reasonable accuracy the ability of the Spanish-dominant child to profit from English language instruction."

According to the text of this proposal, the project's main goal was to predict a student's academic ability in English. The assumption underlying the project goal, was that an estimate of a student's English proficiency in subjects taught in the monolingual classroom would be an accurate predictor of success in the monolingual English program. Due to the difficulty in defining the precursors to success in the monolingual program, we developed a prediction index designed to include several variables. Variables chosen were those thought to be most strongly related to achievement and most amenable to measurement.

The prediction index was constructed in two stages. The first stage was a description of the target population and their school setting as well as isolation of the variables most strongly associated with success in the monolingual program. Some of the potentially important variables we identified were: listening, speaking, reading and writing in English (English proficiency), reading in the native languages (literacy), amount of instruction received in English, and attitudes toward various school subjects as well as toward school itself.

In the second stage of the study techniques and instruments to identify and measure the variables associated with success in the monolingual program were developed and tried out.

Because of the difficulty in defining what constituted an appropriate level of English proficiency for the transitional student, we developed a prediction index based on several variables we felt to be related to success in the monolingual English program.

The prediction index was to be constructed in two stages. The first stage was isolation of those variables which might correlate with success in programs where all instruction is conducted in English. Some of the potentially important variables we identified were: listening, speaking, reading and writing in English; reading in the native language; amount of instruction received in English, and attitudes toward school and various subjects. In addition, information about the school, program and teachers of the target population was to be collected. Finally, demographic factors of the population, such as the amount of time living in the United States, was also to be considered.

In the second stage of the study, techniques and instruments to identify and measure these variables were developed and tested.

Stage 1: Identification of Target Population

The proposed target population consisted of third-grade classrooms of Spanish dominant students who were receiving bilingual instruction. This population was selected for several reasons. The Spanish speaking population in the United States represents the largest ethnic group receiving bilingual education. Consequently, most of the established bilingual programs service

the Spanish speaking population. In addition, most of the available bilingual instructional materials (including tests) were Spanish/English materials. Third grade students were selected because most children in a transitional bilingual program are transferred at this point. This is partly due to the fact that most of the TBE's are funded from K-3 only.

The target population was to be located in the Los Angeles area because of the proximity and accessibility required for these preliminary studies. These classrooms were to be similar in terms of the specified characteristics of the school, program and classroom.

Stage 2: Instrument Selection

A list of the instruments on which the students were to be tested is presented below in Table 1. These were selected because they examine the four basic language skills in English and Spanish. Language attitudes were also assessed because the literature suggests that a student's attitudes toward the primary and secondary languages, as well as his/her attitudes toward the school, could influence his/her ability to learn (Lambert, 1958, 1963, 1972).

A regression analysis was proposed to analyze the strength of the relationship between English reading proficiency and a vector of independent variables selected for the study.

Table 1

Measurement Instruments listed in the 1975 proposal
for the Bilingual Prediction Project

---

Spanish-English Dominance Test, Ramirez, Politzer 1975, Oral language production.

Attitudes Toward Varieties of English and Spanish, Ramirez, Politzer, 1975. Attitudes toward English and Spanish.

Language Use Information Questionnaire, Ramirez, Politzer, language use.

Test of English Comprehension (not selected at that point).

SOBER Level of reading comprehension in Spanish.

SOBAR Level of reading comprehension in English.

Description of school, program, instructor questionnaire (not developed at that point).

---

Pilot Study (1976/1977)

The implementation of the Bilingual Prediction Project started in 1976 with a Pilot Study conducted in California. In this study, the ability to read in English was used as an operational definition of the student's ability to profit from instruction given in English. Some of the CSE reports regarding the Pilot Study state:

> "The purpose of this study (The Pilot Study) is to develop an index which will predict with reasonable accuracy the success of a Spanish dominant child in English reading instruction...(CSE Report, March, 1976)...Reading scores of students

> are being used on the premise that high reading scores indicate high readiness for content instruction given in English. Thus, it is assumed that a second or third grade child who cannot read in English will not do well in content given in English. Conversely, a child's potential for success in English language instruction increases as his ability to read in English increases."
> (CSE Report, September, 1976)

The 1976 Pilot Study attempted to identify variables which could be used as part of an index for the prediction of student success in an instructional setting where all instruction is provided in English. The study also attempted to identify instruments which could reliably measure these variables.

English reading proficiency was chosen as the core variable for determining success in English dominant instruction. English reading comprehension was selected as the dependent variable for several reasons. Although many skills may be used as the criteria which reflects the readiness of a student to transition from a bilingual setting to a monolingual English instructional setting, English reading comprehension is usually the main criteria selected by the schools. In addition, the federal law (and, in many instances, state law) mandates the assessment of students' proficiency in English as a way of monitoring their progress and determining the impact of a bilingual program. For these reasons, the main variable of a prediction index was to be the student's proficiency in English reading. Other indepen-

dent variables were selected: aural and verbal proficiency in English; aural, verbal and reading proficiency in Spanish; attitudes toward school and language, and general demographic characteristics.

The study did not include variables about the social adaptation of the student because it was felt that this dimension was too complex to address in this project. The selection of variables could not be derived from the literature regarding the adaptation of students from a bilingual instructional setting to a non-bilingual instructional setting because the literature was not sufficiently substantial. Furthermore, there were no bilingual instruments available for the assessment of these kinds of variables. Consequently, the selection of variables was limited to those which related to instructional and/or demographic characteristics.

The procedure for selecting those variables was as follows: First teachers and experts of reading comprehension were asked to identify those reading objectives which they considered to be essential in both Spanish and English reading. Second, these objectives were classified into five areas: decoding, comprehension, vocabulary, word structure, and capitalization.

A population of 115 third grade students was selected for the study. These students were enrolled in bilingual programs in five schools in the greater Los Angeles metropolitan area. These were the same students who were selected as the target population in the 1975 proposal. Since this was a preliminary study, schools in the Los Angeles area were selected because they were easily accessible and had a large number of Hispanic students.

The schools were located in two school districts. One district was

located in a highly urbanized section of Los Angeles. The district had an ethnic population of Hispanics, Blacks, Asians, and American Indians. The Hispanic population was comprised of Mexican-Americans, Mexicans, Cubans, Central and South Americans.

The second district was located in an agricultural community in the outskirts of Los Angeles County. Nearly all of the Spanish surnamed pupils were of Mexican descent; only a few members were of other minority population.

The independent variables were measured with instruments in Spanish and English; the instruments were as parallel as possible. The SOBER test, which measures Spanish reading, was constructed using the same objectives as the SOBAR test. The tests used parallel items. Listening Comprehension was measured with the Prueba de Habilidad General for Spanish, and the Test of General Ability for English. Oral production was measured using the English and Spanish versions of the bilingual syntax measured in English and Spanish. Scores from the CTBS were collected for reading vocabulary and comprehension in English. Attitudinal variables were measured with two instruments: the Bilingual Attitudinal Measure (BAM) for language attitude; and the Survey of School Attitudes (SSA), for attitudes toward school activities related to reading, language arts, mathematics and social studies. Table 2, presented below, includes a list of the instruments and a short description of the variables measured.

TABLE 2

List of the Instruments Used in the Pilot Study

---

Reading Ability in English as measured by:

Items for objectives selected from System for Objectives-Based Assessment of Reading (SOBAR: English). Developed by the Center for the Study of Evaluation. Published by Science Research Associates.

Project-developed test. A criterion-referenced measure which assesses the basic global reading skills expected of third-grade students: (1) word attack skills, (2) sight word recognition, and (3) literal comprehension.

Test 1: Reading Vocabulary and Test 2: Reading Comprehension of the Comprehensive Tests of Basic Skills, Level 1. Published by CTB/McGraw-Hill.

Reading ability in Spanish as measured by:

Items on objectives selected from System for Objectives-Based Evaluation of Reading-Spanish (SOBER-Español). Developed by the Center for the Study of Evaluation. Published by Science Research Associates.

Oral production in Spanish as measured by:

The Bilingual Syntax Measure (Spanish version). Authored by Marina K. Burt, Heidi C. Dulay, and Eduardo Hernandez Chavez. Published by Harcourt Brace Janovich, Inc.

Aural comprehension in Spanish as measured by:

Section I: Vocabulario Oral of Pruebas de Habilidad General. Developed with the support of the Office of Education. Published by Guidance Testing Associates.

Oral production in English as measured by:

The Bilingual Syntax Measure (English version). Authored by Marina K. Burt, Hiedi C. Dulay, and Eduardo Hernandez Chavez. Published by Harcourt Brace Janovich, Inc.

Aural comprehension in English as measured by:

Section I: Oral Vocabulary of Tests of General Ability. Developed with the support of the Office of Education. Published by Guidance Testing Associates.

Attitudes toward English and Spanish as measured by:

TABLE 2 (continued)

Bilingual Attitude Measure (Matched Guise Instruments). Developed by Ramirez (1975) at the Stanford Center for Research and Development in Teaching (unpublished, used with author's permission).

Attitude toward school and learning as measured by:

Survey of School Attitudes. Authored by Thomas P. Hogan. Published by Harcourt Brace Janovich, Inc. (Administered in Spanish)

language used with friends
language used with parents
language used with siblings
language used in class
cultural/ethnic membership
sex
age
number of years in the United States
father's occupation
mother's occupation
grandparent in home
number of months of Spanish reading instruction
number of months of English reading instruction
place of birth
enrolled in maintenance vs. transition program

A form was developed for collecting information about each student from his/her classroom teacher (See Table 2). Teachers were asked to provide the following information about each one of the students in their classrooms: age, sex, parent's occupation, ethno-cultural membership, time in the United States, months of reading instruction in English and months of reading instruction in Spanish. In addition, teachers were asked to rate, on a scale from one to seven, each student's likelihood of success in a monolingual English classroom.

## Results of the Pilot Study

Various types of statistical analyses were done using the data collected in the Pilot Study. These analyses and their results are presented in various CSE reports. However, a summary of the results related to the prediction in-

dices included in the User's Manual is provided in this report.

The first results used in the development of the prediction model and in the construction of sample indices are those of the correlations between the variables in the study. Table 3 below shows these correlations (This table was included in the CSE Final Report, December, 1977 -- page 19).

Based on the correlations in Table 3 below, three examples of prediction indices were constructed. A detailed description of the examples is presented in the User's Manual; they are only mentioned here to show how these examples are related to, and consistent with, results previously reported.

Table 3 includes a verbal description of the SOBAR English reading prediction index, and Table 8 shows a summary of the step-wise regression results which were also presented in the Final Report, December, 1977. The examples of prediction indices were constructed using a simple regression instead of a step-wise regression. Thus, the contribution of each one of the independent variables to the prediction is computed separately. (In the User's Manual, as well as in the tables presented below, these independent variables are called "Supplementary Variables").

For purposes of instruction, simple regression analysis is preferable because it makes it easier to interpret the contribution of each supplementary variable. It also allows one to make predictions and decisions for students for whom data are incomplete on in some of the supplementary variables. This is clearly shown in the tables in the User's Manual which summarize the predictions for individual students.

The disadvantage of using simple regression and in treating each of the supplementary variables separately is that when the supplementary variables

Table 3. Language, attitudinal, demographic, and instructional variables: Pearson r correlation matrix.

| | SEX | AGE | TIMEUS | SPRDNG | ENGRDNG | TCHRATE | BSMSP | PRUEBA | BSMENG | TESTGA | SOBAR | ECE | CTBS | SOBER | SCHLATTB | ENGUSE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SEX | - | | | | | | | | | | | | | | | |
| AGE | -.255 | - | | | | | | | | | | | | | | |
| TIMEUS | .013 | -.221 | - | | | | | | | | | | | | | |
| SPRDNG | -.028 | .192 | -.374* | - | | | | | | | | | | | | |
| ENGRDNG | .002 | -.340* | .627* | -.449* | - | | | | | | | | | | | |
| TCHRATE | .120 | -.131 | .240 | -.101 | .488* | - | | | | | | | | | | |
| BSMSP | .122 | .049 | -.195 | .072 | -.089 | .063 | - | | | | | | | | | |
| PRUEBA | .082 | .141 | .070 | .225 | .031 | .264 | .146 | - | | | | | | | | |
| BSMENG | .001 | -.365* | .546* | -.255 | .671* | .496* | -.065 | .118 | - | | | | | | | |
| TESTGA | .051 | -.310 | .464* | -.119 | .516* | .366* | -.149 | .248 | .476* | - | | | | | | |
| SOBAR | .096 | -.152 | .388* | -.077 | .566* | .595* | -.079 | .315* | .547* | .610* | - | | | | | |
| ECE | .055 | -.165 | .494* | .187 | .661* | .569* | -.059 | .098 | .517* | .532* | .804* | - | | | | |
| CTBS | .139 | -.005 | .310 | -.180 | .280 | .432* | .115 | .217 | .480* | .477* | .766* | .739* | - | | | |
| SOBER | .185 | -.068 | -.055 | .266 | .124 | .421* | .264 | .256 | .168 | .134 | .499* | .400* | .429* | - | | |
| SCHLATTB | .110 | .104 | -.167 | .287 | -.041 | .129 | .159 | .219 | -.052 | -.024 | .063 | .038 | .086 | .184 | - | |
| ENGUSE | .101 | -.357* | .678* | -.421* | .702* | .314* | -.073 | -.017 | .610* | .425* | .361* | .414* | .215 | .013 | -.075 | - |
| TLANGATT | .110 | -.083 | -.074 | .056 | -.069 | -.149 | .003 | .116 | -.051 | -.088 | -.101 | -.063 | .017 | .090 | .162 | -. |

TABLE 4

SOBAR (CRITERION-REFERENCED TEST):

PILOT STUDY: ENGLISH READING

Third Grade

The core variable of this index is English Reading.

The core variable is measured by the system for objectives-based assessment-reading (SOBAR).

Supplementary Variables:

R1 = Spanish Reading (SOBER)
R2 = English Speaking (BSMSP)
R3 = English Listening (TESTA)
R4 = Time Living in the United States (TIMEUS)
R5 = Student's Achievement in English (TCHRATE)
R6 = Months of Reading English Instruction (ENGRNG)
R7 = Spanish Listening (PRUEBA)

Measurement Instruments:

R1 was measured by SOBER (Criterion Referenced Test)
R2 was measured by Bilingual Syntax Measure (BSM)
R3 was measured by Test of General Ability (TGA)
R4 was measured by Student Questionnaire
R5 was measured by Teacher Grades
R6 was measured by Teacher Report
R6 was measured by Teacher Report
R7 was measured by Prueba De Habilidad General (PHG)

Additional Information:

S = School Code
ID = Student Identification Number
SUM = R1 + R2 + R3 + R4 + R5 + R7 + R7: Sum of Residual Scores

Prediction Group: (1) = Transfer
Prediction Group: (0) = Undecided
Prediction Group: (-1) = No-Transfer

M = Missing Data

TABLE 5

Summary of Predictions

| Predictions Made by the Index | Number of Students | Percentage of Students |
|---|---|---|
| Prediction Groups | | |
| (1) Transfer Group | 35 | 37 |
| (0) Undecided Group | 3 | 3 |
| (-1) No-Transfer Groups | 57 | 60 |
| TOTALS | 95 | 100 |

| Predictions Made by the Core Variable | Number of Students | Percentage of Students |
|---|---|---|
| Prediction Groups | | |
| (1) Transfer Group | 14 | 15 |
| (0) Undecided Group | 60 | 63 |
| (-1) No-Transfer Group | 21 | 22 |

| Predictions Groups | Core Variable | | Contributions Made By Supplementary Variables | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Transfer | | Undecided | | No-Transfer | |
| | Number | % | Number | % | Number | % | Number | % |
| (1) Transfer | 14 | 15 | 14 | -- | 0 | -- | 0 | -- |
| (0) Undecided | 60 | 63 | 21 | (35) | 3 | (5) | 36 | (60) |
| (-1) No-Transfer | 21 | 22 | 0 | -- | 0 | -- | 21 | -- |

Interpretation of the Numbers in Parenthesis:

Numbers in parenthesis indicate the percentage (%) of students who were originally assigned to the "undecided" group according to the prediction made by the core variable alone. The students were reassigned to one of the three groups according to the Prediction Index.

For example, the number (35) indicates that 35% of the 60 students who were in the "undecided" group (according to the core variable) were reassigned to the "transfer" group according to the Prediction Index.

are highly intercorrelated may tend to provide overlapping information. Fortunately, the effects of this phenomenon are not very important to the actual use of the indices. For a more detailed description of these effects, please see the User's Manual.

Tables 6 to 11 display the ECE and the CTBS/S prediction indices obtained from the step-wise regressions previously reported (CSE Final Report, December, 1977 -- pages 28, and 30). For these sample prediction indices, attitudinal variables were not used. These variables, (as they were measured in the Pilot Study), show no correlation with the English reading scores that were used as core variables for the indices. Thus it was not possible to use these attitudinal variables as supplementary variables for these indices. The correlations between three measures of English reading (core variables of these three indices) and the measures of attitudes toward school and attitudes towards language are presented below in Table 12.

TABLE 12

Pearson Moment Correlations Between Attitude Measures and English Reading

| | ENGLISH | | READING |
|---|---|---|---|
| | SOBAR | ECE | CTBS/S |
| Attitudes toward SCHOOL | .06 | .04 | .09 |
| Attitudes toward LANGUAGE | -.10 | -.06 | .02 |

The use of these attitudinal variables as "core" variables for prediction indices is not possible because their measurement took place while

TABLE 6

ECE (CRITERION-REFERENCED TEST):

PILOT STUDY: ENGLISH READING

Third Grade

The core variable of this index is English Reading.

The core variable is measured by the Early Childhood Evaluation Test (ECE).

Supplementary Variables

R1 = Spanish Reading (SOBER)
R2 = English Listening (TESTGA)
R3 = Time Living in the United States (TESTUS)
R4 = Student's Achievement in English (TCHRATE)
R5 = Months of Reading Instruction in English (ENGRNG)

Measurement Instruments

R1 was measured by SOBER (Criterion-Referenced Test)
R2 was measured by Test of General Ability
R3 was measured by Student Questionnaire
R4 was measured by Teacher Grades
R5 was measured by Teacher Report

Additional Information

S = School Code
ID = Student Identification Number
SUM = R1 + R2 + R3 + R4 + R5: Sum of residual scores

Prediction Group: (1) = Transfer
Prediction Group: (0) = Undecided
Prediction Group: (-1) = No-Transfer

M = Missing Data

TABLE 7

Summary of Predictions

| Predictions Made by the Index | Number of Students | Percentage of Students |
|---|---|---|
| Prediction Groups | | |
| (1) Transfer Group | 44 | 49 |
| (0) Undecided Group | 1 | 1 |
| (-1) No Transfer Group | 45 | 50 |
| TOTALS | 90 | 100 |

| Predictions made by the Core Variable | Number of Students | Percentage of Students |
|---|---|---|
| Prediction Groups | | |
| (1) Transfer Group | 14 | 16 |
| (0) Undecided Group | 36 | 40 |
| (-1) No-Transfer Group | 40 | 44 |

| Prediction Groups | Core Variable | | Contributions Made By Supplementary Variables | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Transfer | | Undecided | | No-Transfer | |
| | Number | % | Number | % | Number | % | Number | % |
| (1) Transfer | 14 | 16 | 14 | -- | 0 | -- | 0 | -- |
| (0) Undecided | 36 | 40 | 30 | (83) | 1 | (3) | 5 | (14) |
| (-1) No-Transfer | 40 | 44 | 0 | -- | 0 | -- | 40 | |

Interpretation of the Numbers in Parenthesis:

Numbers in parenthesis indicate the percentage (%) of students who were originally assigned to the "undecided" group according to the prediction made by the core variable alone. The students were reassigned to one of the three groups according to the Prediction Index.

For example, the number (14) indicates that 14% of the 36 students who were in the "undecided" group (according to the core variables were reassigned to the "No Transfer" group according to the Prediction Index.

Table 8 Summary table of multiple step-wise regression analysis, using ECE as the dependent measure.

| (n=47) | Multiple R | $R^2$ | $R^2$ Change | Simple r | B* | Beta** |
|---|---|---|---|---|---|---|
| ECE with | | | | | | |
| ENGRDNG | .601 | .361 | .361 | .601 | .380 | .480 |
| SOBER | .831 | .691 | .330 | .591 | .713 | .661 |
| TIMEUS | .856 | .733 | .042 | .467 | .654 | .335 |
| TCHRATE | .873 | .761 | .028 | .403 | -.443 | .122 |
| SCHLATTB | .878 | .771 | .010 | .063 | .497 | .135 |
| BSMSP | .883 | .779 | .008 | .008 | -.844 | -.078 |
| SPRDNG | .884 | .782 | .003 | -.225 | .937 | .093 |
| TLANGATT | .886 | .785 | .003 | .180 | .131 | .058 |
| SEX | .887 | .787 | .002 | .020 | -.644 | -.048 |
| ENGUSE | .888 | .788 | .001 | .258 | -.385 | -.085 |
| TESTGA | .888 | .788 | .000 | .355 | .860 | .053 |
| PRUEBA | .888 | .789 | .001 | .144 | -.144 | -.066 |
| BSMENG | .889 | .791 | .002 | .366 | .462 | .057 |
| AGE | .890 | .791 | .000 | .040 | .254 | .031 |
| (Constant) | | | | | -4.701 | |

*B = Unstandardized beta weight or regression coefficient
**Beta = Standardized beta weight or regression coefficient

# TABLE 9

## EXAMPLE OF PREDICTION INDEX

CTBS/S NORM-REFERENCED TEST): PILOT STUDY: ENGLISH READING

### THIRD GRADE

THE CORE VARIABLE OF THIS INDEX IS ENGLISH READING

THE CORE VARIABLE IS MEASURED BY THE COMPREHENSIVE TEST OF BASIC SKILLS, FORM S (CTBS/S): TOTAL READING SCORES

SUPPLEMENTARY VARIABLES:

R1 = SPANISH READING (SOBER)
R2 = ENGLISH SPEAKING (BSMENG)
R3 = ENGLISH LISTENING (TESTGA)
R4 = TIME LIVING IN THE UNITED STATES (TIMEUS)
R5 = STUDENT'S ACHIEVEMENT IN ENGLISH (TCHRATE)
R6 = MONTHS OF READING INSTRUCTION IN ENGLISH (ENGRNG)
R7 = SPANISH LISTENING (PRUEBA)

MEASUREMENT INSTRUMENTS:

| | | | | |
|---|---|---|---|---|
| R1 | WAS | MEASURED | BY | SOBER (CRITERION-REFERENCED TEST) |
| R2 | WAS | MEASURED | BY | BILINGUAL SYNTAX MEASURE (BSM) |
| R3 | WAS | MEASURED | BY | BILINGUAL SYNTAX MEASURE (BSM) |
| R4 | WAS | MEASURED | BY | STUDENT QUESTIONNAIRE |
| R5 | WAS | MEASURED | BY | TEACHER GRADES |
| R6 | WAS | MEASURED | BY | TEACHER REPORT |
| R7 | WAS | MEASURED | BY | PRUEBA DEHABILIDAD GENERAL |

ADDITIONAL INFORMATION:

S = SCHOOL CODE
ID = STUDENT IDENTIFICATION NUMBER
SUM = R1 + R2 + R3 + R4 + R5 + R6 + R7: SUM OF RESIDUAL SCORES

PREDICTION GROUP : ( 1) = TRANSFER
PREDICTION GROUP : ( 0) = UNDECIDED
PREDICTION GROUP : (-1) = NO-TRANSFER

M = MISSING DATA

## TABLE 10

## SUMMARY OF PREDICTIONS

| PREDICTIONS MADE BY THE INDEX | | NUMBER OF STUDENTS | PERCENTAGE OF STUDENTS |
|---|---|---|---|
| PREDICTION GROUPS | | | |
| ( 1) | TRANSFER GROUP | 15 | 40 |
| ( 0) | UNDECIDED GROUP | 1 | 3 |
| (-1) | NO-TRANSFER GROUP | 21 | 57 |
| | TOTALS | 37 | 100 |

| PREDICTIONS MADE BY THE CORE VARIABLE | | NUMBER OF STUDENTS | PERCENTAGE OF STUDENTS |
|---|---|---|---|
| PREDICTION GROUPS | | | |
| ( 1) | TRANSFER GROUP | 0 | 0 |
| ( 0) | UNDECIDED GROUP | 22 | 59 |
| (-1) | NO-TRANSFER GROUP | 15 | 41 |

| | | CONTRIBUTIONS MADE BY | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | CORE VARIABLE | | SUPPLEMENTARY VARIABLES | | | | | |
| PREDICTION GROUPS | | | | TRANSFER | | UNDECIDED | | NO-TRANSFER | |
| | | NUMBER | % | NUMBER | % | NUMBER | % | NUMBER | % |
| ( 1) | TRANSFER | 0 | 0 | 0 | -- | 0 | -- | 0 | -- |
| ( 0) | UNDECIDED | 22 | 59 | 15 | 68 | 1 | ( 5) | 6 | (27) |
| (-1) | NO-TRANSFER | 15 | 41 | 0 | -- | 0 | -- | 15 | -- |

INTERPRETATION OF THE NUMBERS IN PARENTHESIS:

NUMBERS IN PARENTHESIS INDICATE THE PERCENTAGE (%) OF STUDENTS WHO WERE ORIGINALLY ASSIGNED TO THE 'UNDECIDED' GROUP ACCORDING TO THE PREDICTION MADE BY THE CORE VARIABLE ALONE. THE STUDENTS WERE REASSIGNED TO ONE OF THE THREE GROUPS ACCORDING TO THE PREDICTION INDEX.

FOR EXAMPLE, THE NUMBER (27) INDICATES THAT 27% OF THE 22 STUDENTS WHO WERE IN THE "UNDECIDED" GROUP (ACCORDING TO THE CORE VARIABLE) WERE REASSIGNED TO THE 'NO-TRANSFER' GROUP ACCORDING TO THE PREDICTION INDEX.

Table 11 Summary table of multiple step-wise regression analysis, using CTBS as the dependent measure.

| (n=47) | Multiple R | $R^2$ | $R^2$ Change | Simple r | B* | Beta ** |
|---|---|---|---|---|---|---|
| CTBS with: | | | | | | |
| TESTGA | .538 | .290 | .290 | .538 | 1.276 | .341 |
| SOBER | .694 | .482 | .192 | .512 | 1.309 | .528 |
| TIMEUS | .813 | .660 | .178 | .515 | .190 | .423 |
| SPRDNG | .833 | .693 | .033 | -.370 | -.621 | -.269 |
| SCHLATTB | .851 | .725 | .032 | .031 | .238 | .282 |
| BSMENG | .863 | .746 | .021 | .483 | 4.683 | .250 |
| TCHRATE | .868 | .753 | .007 | .420 | -.716 | -.086 |
| SEX | .871 | .759 | .006 | .203 | 2.420 | .079 |
| PRUEBA | .873 | .762 | .003 | .255 | -.665 | -.133 |
| ENGUSE | .875 | .765 | .003 | .340 | -1.016 | -.098 |
| ENGRDNG | .877 | .769 | .004 | .516 | -.181 | -.099 |
| AGE | .877 | .770 | .001 | -.011 | .723 | .039 |
| TLANGATT | .878 | .771 | .001 | .109 | .232 | .044 |
| BSMSP | .879 | .772 | .001 | .138 | 1.158 | .046 |
| (Constant) | | | | | -54.275 | |

*B = Unstandardized beta weight or regression coefficient
**Beta = Standardized beta weight or regression coefficient

the students were in the bilingual program. For example, student attitudes toward school as measured in the Pilot Study, do not include the type of schooling that reflects the environment of a monolingual English program. Also, there are no attitudinal data from a reference group that can be used to link the attitudes of students in the bilingual program to the attitudes of a comparable group of students in the monolingual English program.

Regarding the measures of student's attitudes toward language, the lack of data from a reference group makes it impossible to use these variables as core variables for a prediction index.

Interestingly enough, the data on the factor analysis done in the Pilot Study data (CSE Report, April, 1977), shows that these attitudinal measures tend to define two separate factors: one that clusters all the measures toward school, and the other that includes all the measures of attitudes towards language (Factors 2 and 4 in Table 16 below).

The results of this factor analysis are presented below. These results can also be used as evidence supporting the prediction model and/or the examples of prediction indices resulting from the Bilingual Prediction Project.

For example, Table 13, below, includes a list of the variables used in the factor analysis. Table 14 shows the matrix of factor loadings of the six factors obtained after a Varimax rotation. Table 15 presents the percentage of the variance accounted for by each one of these factors, as well as their cumulative contributions. Table 16 includes a short description of the six factors.

As can be seen from the data in these tables, factor Number One includes all the variables used as "supplementary variables" in the examples of

TABLE 13

Variables Included in Factor Analysis:
Names And Descriptions

| | |
|---|---|
| ENGUSE | - Use of conversational English |
| AGE | - Age |
| TIMEUS | - Time subject has spent in the U.S. |
| SPRDNG | - Months of instruction in Spanish reading |
| ENGRDNG | - Months of instruction in English reading |
| TCHRATE | - Teacher's rating of subject's English Reading ability |
| BSMSP | - Spanish verbal proficiency |
| PRUEBA | - Spanish aural proficiency |
| BSMENG | - English verbal proficiency |
| TESTGA | - English aural proficiency |
| READATT | - Attitudes toward reading |
| MATHATT | - " " mathematics |
| SCIATT | - " " science |
| SSOCATT | - " " social studies |
| LANGATT 1 | - Attitudes toward non-standard English |
| LANGATT 2 | - Attitudes toward standard English |
| LANGATT 3 | - " " standard Spanish |
| LANGATT 4 | - " " code-switching (English-Spanish) |
| DECODE | - English decoding skills |
| COMPREN | - English comprehension skills |
| VOCAB | - English vocabulary skills |
| LEER | - Spanish decoding, comprehension, and vocabulary skills |

TABLE 14

Varimax Rotated Factor Matrix

| | FACTOR 1 | FACTOR 2 | FACTOR 3 | FACTOR 4 | FACTOR 5 | FACTOR 6 |
|---|---|---|---|---|---|---|
| ENGUSE | 0.79 | -0.00 | -0.09 | -0.00 | -0.13 | -0.21 |
| AGE | -0.47 | 0.10 | -0.12 | 0.28 | -0.13 | 0.14 |
| TIMEUS | 0.69 | -0.11 | -0.00 | 0.19 | -0.27 | -0.06 |
| SPRDNG | -0.36 | 0.20 | -0.01 | -0.22 | 0.16 | 0.61 |
| ENGRDNG | 0.85 | 0.01 | -0.02 | 0.13 | -0.00 | -0.14 |
| TCHRATE | 0.53 | 0.11 | -0.17 | 0.17 | 0.33 | 0.19 |
| BSMSP | -0.12 | 0.13 | -0.01 | 0.07 | 0.33 | -0.03 |
| PRUEBA | 0.10 | 0.17 | 0.07 | 0.15 | 0.07 | 0.45 |
| BSMENG | 0.77 | -0.03 | 0.01 | 0.11 | 0.04 | 0.04 |
| TESTGA | 0.62 | -0.03 | -0.04 | 0.20 | -0.08 | 0.26 |
| READATT | -0.03 | 0.86 | 0.11 | 0.06 | 0.26 | 0.02 |
| MATHATT | -0.11 | 0.88 | 0.09 | -0.01 | 0.15 | 0.07 |
| SCIATT | 0.03 | 0.87 | 0.01 | 0.01 | -0.09 | 0.13 |
| SSCCATT | -0.02 | 0.91 | 0.05 | -0.02 | 0.07 | 0.18 |
| LANGATT 1 | -0.19 | 0.19 | 0.74 | -0.26 | -0.13 | -0.06 |
| LANGATT 2 | -0.12 | 0.10 | 0.85 | 0.22 | 0.16 | 0.10 |
| LANGATT 3 | 0.02 | 0.07 | 0.75 | 0.20 | 0.23 | 0.15 |
| LANGATT 4 | -0.07 | -0.05 | 0.68 | -0.12 | -0.16 | -0.07 |
| DECODE | 0.72 | 0.00 | -0.03 | 0.34 | 0.23 | 0.21 |
| COMPREN | 0.49 | 0.05 | 0.04 | 0.65 | 0.34 | 0.04 |
| VOCAB | 0.44 | -0.02 | 0.04 | 0.86 | 0.25 | 0.03 |
| LEER | 0.12 | 0.08 | 0.08 | 0.17 | 0.73 | 0.29 |

TABLE 15

Eigenvalues and Proportion of Variance
of Six Major Factors

| FACTOR | EIGENVALUE | PCT OF VAR | CUM PCT |
|---|---|---|---|
| 1 | 5.66540 | 25.8 | 25.8 |
| 2 | 4.13507 | 18.8 | 44.5 |
| 3 | 2.50190 | 11.4 | 55.9 |
| 4 | 1.92787 | 8.8 | 64.7 |
| 5 | 1.12033 | 5.1 | 69.8 |
| 6 | 1.05626 | 4.8 | 74.6 |

TABLE 16

The six factors may be described as follows:

FACTOR 1 - The following variables loaded high on this factor: ENGUSE, TIMEUS, ENGRDNG, BSMENG, and DECODE. The first four variables all relate to exposure to converstional Englsih; DECODE is an English reading skill which seemingly bears some relationship to this language exposure.

FACTOR 2 - The four attitude toward school measures loaded high on this factor which can, therefore, be characterized as a school attitude factor.

FACTOR 3 - The four language attitude measures loaded high on this factor, attitude toward language.

FACTOR 4 - COMPREN and VOCAB loaded high on Factor 4. Both of these are measures of English reading proficiency that are dependent on knowledge of the language.

FACTOR 5 - LEER, a measure of Spanish reading proficiency that includes decoding, vocabulary, and comprehension skills, was the only variable that loaded high on Factor 5.

FACTOR 6 - Listening comprehension in Spanish (PRUEBA) and SPRDNG, a measure of months of instruction in Spanish, and included in this factor.

prediction indices (presented in the tables above). Factors Two and Three, which reflect the attitudinal measures, were discussed above. Factor Four includes measures of reading comprehension and English vocabulary; this justifies the use of the total scores in English reading as the core variable of the CTBS/S prediction index. Factor Five represents Spanish Reading, which again is used as one of the supplementary variables in the indices. Factor Six, months of instruction in Spanish reading listening comprehension, is represented in two of the three prediction indices by PRUEBA.

The purpose of the factor analysis done with the Pilot Study data was to reduce the number of independent variables. Therefore, measures of English reading were not included in it. However, a study of the correlations between the three measures of English reading was available: SOBAR, ECE, and CTBS/S reading scores indicate that these three measures are highly correlated. Table 17 below shows the correlations between these three measures. This table was previously presented in a CSE Report (December, 1977 -- page 24).

These correlations show that any one of these three measures could be used as the core variable of a prediction index constructed to predict reading in English. However, for practical purposes, there are some limitations in the use of SOBAR and ECE measures. These limitations refer to the unavailability of such test data from a reference group.

It is explained in the User's Manual that the group recommended as the most acceptable reference group for the assessment of the predictions made by the core variable is a group of students who are comparable to those in the bilingual program and who are attending the monolingual English program to which the students in the bilingual program are likely to be transferred.

This means that the students in the reference group should be enrolled in the same school district and that they should be the same grade level as those students in the bilingual program for whom transition decisions are to be made.

When using data from the Pilot Study to construct the examples of prediction indices included in the manual, we found it very difficult to obtain data on a group of students who fit the description of the recommended reference group. Specifically, it was easier to obtain the scores for the appropriate reference group for the CTBS/S English reading index. Fortunately, because the ECE test was constructed for a study done by the Center for the Study of Evaluation, data on the ECE test for a group of students attending monolingual programs was available. However, this group of students is not the one that is recommended in the User's Manual because it does not include students enrolled in the school districts of those students in the sample of the Pilot Study. Since the indices constructed are only examples, it was decided this group be used as a reference group. However, this group could not be used if real decisions were to be made regarding the transition of the students in the study.

The same type of difficulty was encountered with the SOBAR scores. There were no data available for a reference group on SOBAR. Thus, in order to construct the prediction index, as an example, it was necessary to estimate the performance of the students in the reference group used for the CTBS/S index if they were also given the SOBAR test. Thus, SOBAR AND CTBS/S scores were statistically equated as a way of estimating the average performance and standard deviation of a reference group. This was only possible because test scores in both SOBAR and CTBS/S were available and also because CTBS/S were

available for the reference group.

In reality, however, most school districts probably would not have test scores available for two or more measures of reading comprehension for both the students in the bilingual programs and the reference group of students in the monolingual programs.

TABLE 17

Measures of English Reading Proficiency: Intercorrelations

| | SOBAR | ECE | CTBS |
|---|---|---|---|
| SOBAR | - | | |
| ECE | .804* | - | |
| CTBS | .766* | .738* | - |

*p .001

Conclusions: Pilot Study

There are two aspects to the Pilot Study: the search for means for developing a single prediction index; and the use of reading test scores in English as the operational definition of success in a monolingual English program.

The first of these two aspects, the constraint to develop a single prototype "broadly applicable prediction index" (CSE Report, January, 1977), has had serious implications for the design and implementation of the study. Conceived to reach this goal, the Pilot Study had to assume that success in a monolingual English program could be represented and predicted by a single

outcome. This being the case, such an outcome had to be selected, and it seemed reasonable to choose reading in English as the single outcome.

However, there is no need for constraining the study to the development of a single prediction index. On the contrary, the more indices that one could use for making a prediction of success in monolingual English programs, the more accurate the final decision regarding the transition of a given student. Reading scores in English are to be included, and at least one prediction index should be constructed, using them as the core variable; it is important to recognize that reading in English is a necessary but not a sufficient condition for achieving success in a monolingual English program.

If several indices are used, it is possible for the educator to assess the congruency of the predictions made for a given student across indices. If these predictions are congruent and all or most of them indicate, for example, that the student is likely to be ready for transition, then a transition decision is likely to be accurate. On the other hand, if there is incongruency and/or contradiction in the predictions across the indices, the educator may conclude that more information about the student is needed before making a transition decision.

The Follow-Up Study (1977)

In the Spring of 1977, the Bilingual Prediction Project continued with the Follow-Up Study. This Follow-Up Study was designed to validate the findings of the Pilot Study, that is, to validate reading in English as a predictor of success for students transferred to monolingual English programs. Because the Follow-Up Study is relevant to the process of validating prediction indices, its findings and conclusions are discussed in Chapter Three of this report.

The Extended Sample Study (1977/1978)

The Extended Sample Study was conducted in the Fall of 1977, after the Follow-Up Study. This study was proposed to replicate the findings of the Pilot Study and to extend the research by including a sample of students with Puerto Rican backgrounds. The Extended Sample Study proposed to further investigate the criterion and independent variables which were identified in the Pilot Study as having positive and significant correlation with the ability to perform well in an English instructional setting. In addition, the study examined the validity and reliability of the available instruments that could be used to measure those variables, as well as the comparability of results between different instruments used to measure the same constructs.

Two cohort groups were selected to explore the relationship between language proficiency and classroom performance prior to and following transition. However, due to difficulties in data collection and in the identification of an adequate sample of fourth grade transitioned students, this analysis was not done. Some of the difficulties in obtaining the 4th grade sample were due to high attrition rates, others to incomplete student data. (See CSE Report, August 1978, for further details). The second phase of the study included a follow-up of the current year's third graders subsequent to their transition to monolingual English classrooms. This phase was planned for the winter of 1978.

The sample for the Extended Sample Study consisted of approximately two hundred students in a Los Angeles school district and two hundred students enrolled in three school districts in Massachusetts. The Eastern population was of predominantly Puerto Rican and Dominican origin; the students on the

West Coast were mainly of Mexican and Mexican-American origin. Students differing in ethnic background and geographical settings were selected in order to insure the generalizability of the prediction indices across cultures with common language as well as across different instructional settings.

Half of the sample from each region was to be drawn from current third grade bilingual classrooms, and half from monolingual English classrooms in the same schools.

Two batteries, including different sets of tests, were assembled; half of the students (on each coast) were tested with Battery I, while the other half was tested with Battery II. Battery I consisted of some of the same tests that were used in the Pilot Study, with the exception of the Early Childhood Education test (ECE), which was omitted in order to shorten the testing time. The attitude tests were substituted by an instrument developed by the project. This instrument was included in both batteries. Battery II consisted of tests that were not previously used in the Pilot Study.

The purpose of using two different batteries of tests was to obtain data that would allow for the comparison of results across constructs which were similar, but which were measured by different instruments. Both batteries included tests designed to measure reading, listening comprehension and oral language production in English and Spanish. Criterion-referenced reading tests were included in these batteries. These tests used the following items to assess the mastery of objectives: Word Attack, Syntax, Vocabulary, and Literal Comprehension. In these tests, approximately four objectives within each of the categories were tested. The batteries were adjusted to be as parallel as possible.

Table 18 below, includes a list of the tests in each battery.

TABLE 18

Test Batteries Used in the Extended Sample Study

| BATTERY I | BATTERY II | AREA MEASURED |
|---|---|---|
| | | English |
| SOBAR | Eric Rdg. Test | Reading Comprehension |
| SOBER | New York Lab Test | Spanish |
| | Babel Rdg. Test | Reading Comprehension |
| Test of General Ability<br>Prueba De Habilidad General | New York Lab | Listening Comprehension |
| Bilingual Syntax Measure | New York Lab | Oral Production |
| School Attitudes Test (Project Developed) | School Attitudes Test (Project Developed) | Attitudes Toward Language and Instruction |

A student information sheet was filled out for each student. The information collected pertained to the student's demographic background, the teacher's ratings of the student's performance in a variety of subject areas, and the type of instruction given. This information was selected because many of these variables correlated significantly with English reading proficiency.

As in the Pilot Study, the Extended Sample Study also had as its goal the development of a single index to predict student readiness to profit from monolingual English instruction. Such an index proved useful for making predictions across cultural backgrounds, ethnic backgrounds, geographical area, instructional area, and measurement instruments.

To insure a degree of generalizability in the use of the prediction

index, the Extended Sample Study pursued the following objectives:

* It was designed to investigate whether the matrices of inter-correlation among the dependent and independent variables included in the index were sufficiently similar to guarantee the generalizability of the index across geographical areas/cultural-ethnic backgrounds;

* It was also designed to study the correlation matrices within and between tests batteries to find out whether the similarity of the matrices would guarantee the generalizability of the index.

* Finally, it was designed to study the effects that the differences in instructional emphasis (in both the bilingual and the monolingual English programs) had on these correlation matrices.

Results of the Extended Sample Study

The results of the Extended Sample Study show that the correlation matrices between the dependent and independent variables are significantly different from one region to another, from one ethnic population to another, from one test battery to another, and from one grade to another. These results strongly indicate that the objective of developing a single prediction index is not appropriate.

The results of the Extended Sample Study can be summarized as follows:

* On the average, the performance of students from different geographical regions/ethnic groups was significantly different. This difference could be due to the fact that students on the West Coast receive more instruction in English than students on the East Coast (See CSE Report, August, 1978; pages 8-34).

* On the average, there were significant differences between test batteries and significant interactions between test batteries and geographical regions.

* The correlation matrices within each test battery were also different depending on the geographical region (CSE Report, August, 1978; Tables 6, and 7; pages 19 and 20).

* Regression analysis, using teacher's grades as dependent measures, resulted in different equations for Battery I and Battery II. This analysis also indicates that there were significant differences between geographical regions.

The CSE Final Report of the Extended Sample Study (August, 1978) concludes that:

> "...where specific test instruments are to be recommended for use in prediction contexts, the test should be locally normed. Since what is being predicted is potential for success in a particular regional setting, measures should reflect normative levels of success within that setting." (CSE Report, August, 1978; pages 39 and 40).

TABLE 19

Battery I (West Upper Triangle and East Lower Triangle)

| | ELIST | SLIST | ESPEK | SSPEK | EREAD | SREAD |
|---|---|---|---|---|---|---|
| ELIST | -- | .19 (50) | .41** (48) | -.14 (52) | .64** (51) | .53** (53) |
| SLIST | .40** (52) | -- | -.11 (44) | -.07 (48) | .18 (48) | .19 (49) |
| ESPEK | .41** (54) | .09 (51) | -- | -.28* (48) | .63** (45) | .38** (48) |
| SSPEK | .40** (52) | .31* (50) | .27* (58) | -- | -.09 (50) | .40** (50) |
| EREAD | .23* (54) | .09 (54) | .62** (51) | .10 (52) | -- | .60** (50) |
| SREAD | .18 (60) | .44** (51) | .19 (54) | .18 (53) | .44** (54) | -- |

*p<.05

**p<.01

TABLE 20

Battery II (West Upper Triangle and East Lower Triangle)

| | ELIST | SLIST | ESPEK | SSPEK | EREAD | SREAD |
|---|---|---|---|---|---|---|
| ELIST | -- | .23 (34) | .33* (42) | .33* (43) | .57** (45) | .10 (35) |
| SLIST | -.03 (48) | -- | -.30* (35) | -.09 (33) | .27 (34) | .32* (36) |
| ESPEK | .44** (38) | -.06 (43) | -- | .20 (44) | .39** (42) | -.18 (36) |
| SSPEK | .07 (41) | .30* (45) | .21 (42) | -- | .21 (42) | .36* (35) |
| EREAD | .53** (43) | .07 (46) | .41** (36) | -.06 (37) | -- | .40** (34) |
| SREAD | .01 (43) | .14 (50) | .32* (42) | .14 (44) | .08 (42) | -- |

*p<.05

**p<.01

General Conclusions from the Pilot and Extended Sample Studies

The findings of both the Pilot Study and the Extended Studies suggest that it would not be possible to construct a single prediction index to predict the readiness of all bilingual students to transfer from a bilingual to a regular monolingual English program. There are several reasons for this finding. Both studies showed that a single outcome, such as a student's English reading score would not provide sufficient information for deciding when a student is ready to transfer from a bilingual English/Spanish to a monolingual English classroom. Predictions vary according to the variables selected and the instruments used to measure them. Furthermore, the same index can produce different results when used with different populations. This leads to the conclusion that prediction indices should be used for a particular target population.

Even if a single index could be created, experience with data collection in different schools suggested that it would be impractical to do so. The lack of uniformity in the type of information available in school districts became evident during the data collection process. Participating schools presented a spectrum of instructional goals, objectives and methods, and used a wide variety of assessment instruments. Consequently, it seemed unrealistic and impractical to attempt to identify specific variables and instruments to fulfill all or even most of their varied needs. Therefore, it became clear that school districts would need to construct prediction indices which are uniquely appropriate to their student population and instructional programs. A single index would not fulfill the prediction needs of different school districts.

It was concluded that the Bilingual Prediction Project would best serve school districts by developing a prediction model that could be used for constructing indices tailor-made to the resources and needs of the students in particular instructional settings. In this manner, a district could construct its own prediction indices using the data available in the district, and enlisting the expertise of its own teachers and school administrators. Indices constructed in this way could better respond to the idiosyncracies of the students, the curricula in both the bilingual and the monolingual English programs, and the availability of information regarding the students for whom transition decisions are to be made.

Finally, such a prediction model has the advantage of allowing the districts to select a student reference group which is representative of the students likely to become the classmates of the transferred students.

Thus, during 1978-1979, the research activities of the Bilingual Prediction Project were directed at the development of a prediction model that would allow for the construction of prediction indices using any type of relevant school data while allowing for the selection of appropriate reference groups of students in the monolingual English programs. The goal was twofold: The prediction model would have to be applicable in school districts with limited resources; and it would have to be usable for educators who do not have expertise in the fields of measurement and statistics.

The result of this effort was a prediction model that consists of five basic components: a core variable; a set of prediction groups; a reference group of students in monolingual programs; a set of supplementary variables; and a set of prediction rules. This prediction model is explained in detail

in the User's Manual. This manual also includes examples of prediction indices constructed using the model. The indices use test scores in English reading as the core variable. However, prediction indices could be constructed using information (test scores) about other core areas of the monolingual English program to which students are going to be transferred. For example, math test scores could also be used for constructing prediction indices.

During the 1978/1979 academic year, there was an attempt made to collect longitudinal information for validating the prediction indices constructed in this model. Thus, test data and information were collected regarding the transition of students in the Pilot and the Extended Sample Studies. These data were to be used to validate the examples of indices presented in the User's Manual. However, due to the small size of the sample for whom longitudinal data was available, and due to complications related to the collection of longitudinal data in the East coast, this validation effort resulted in very tentative conclusions.

It is recommended that future efforts be made to validate the prediction model and the examples of prediction indices. The results of the 1978/1979 validation effort and the various theoretical models could be used for validating these predictions.

## CHAPTER TWO

## PROCEDURES FOR CONSTRUCTING PREDICTION INDICES

There are various statistical procedures that can be used for making predictions about the future performance of students. In 1978-1979, two of these procedures were investigated as part of the Bilingual Prediction Project. The two procedures are the use of Expectancy Tables of pairs of variables and the use of statistical regression models.

Before presenting the advantages and disadvantages of constructing prediction indices with these two procedures, it is necessary to point out some of the limitations of the educational situation within which these indices are to be constructed.

The greatest limitation for the use of either one of these two procedures is the small sample size of the target population of students for whom decisions are to be made regarding entry to bilingual programs, transition from one mode of instruction to another, and/or exit from bilingual programs.

Most of these decisions tend to be made within a classroom. To solve the problem of small sample size, an attempt was made to construct indices at grade levels within a school, or preferably across various schools within a school district. At this level, the sample of target students is likely to increase from less than thirty students in a classroom to one hundred or more students across four of five classrooms.

However, these indices should be sensitive to the characteristics and backgrounds of the target students as well as to the characteristics of the school district. This means that prediction indices should be constructed

using data obtained by target and non-target students enrolled in the same grade level and attending the same school district.

An exception to this rule can be made when there are several school districts in adjacent areas. Such school districts are likely to have similar characteristics in terms of educational parameters and student populations.

The construction of prediction indices for general application is discouraged because the data collected in the 1975-1976 Pilot Study and in the 1977-1978 Extended Sample Study indicate that there are significant differences in the relationships among the same variables when the populations of students are different.

Use of Expectancy Tables of Pairs of Variables

In the 1979 Proposed Activities for the Bilingual Prediction Study, the use of Expectancy Tables as a procedure for constructing prediction indices was suggested.

In that document, it was stated that Expectancy Tables were recommended as one way to avoid the difficulties and "shortcomings" of the use of regression models in the construction of prediction indices. Several shortcomings were described and an example of the use of Expectancy Tables for constructing an index to predict performance in English reading was presented.

During the first months of the academic year of 1978-79, the usefulness of Expectancy Tables in the construction of prediction indices was further investigated. In an attempt to construct prediction indices, Expectancy Tables were constructed using data obtained by target students in the 1975-1976 Pilot Study and in the 1977-78 Extended Sample Study.

Even though it was found that the Expectancy Tables were easy to under-

stand and compute within the context and with the facilities of a small school district, this procedure was abandoned as a way for constructing prediction indices. There were two reasons for this.

First Expectancy Tables do not allow direct use of the information provided by the correlation of the pair of variables included in the table, i.e., the core and the supplementary variables. Expectancy Tables do not allow one to directly determine the necessary rules for assigning target students to performance groups.

Second, Expectancy Tables do not provide information about the performance of target students in relation to the performance of non-target monolingual English or English proficient students. These monolingual English or English proficient students are likely to become the classmates of the target students once these target students exit from the bilingual program. Thus, scores in the core variable of the Expectancy Table show the standing of a target student relative to the group of bilingual students who are his/her classmates in the bilingual program. These scores do not indicate the standing of a target student relative to a population of monolingual English students attending regular English programs. To assess the relative standing of a target student as compared to that of the students attending the regular English monolingual classroom to which the target student could be transferred is essential for making predictions about the readiness of the target student to profit from English instruction.

Use of a Simple Regression Procedure

After it was concluded that Expectancy Tables were not sufficiently useful for constructing prediction indices, the usefulness of regression procedures

was studied.

Regression models were considered because they have the advantage of using the maximum information contained in the correlation between the core and the supplementary variables.

Several regression models were used for constructing prediction indices; e.g., simple regression, step-wise regression, and multiple regression. It was found that due to the small sample size, there were no great advantages in using more complex regression models. In addition, when regression models of greater complexity were used, the interpretation of the results of the application of prediction indices was more complicated than when the indices were constructed using simple regression.

When a prediction index includes various core and supplementary variables likely to have intercorrelations statistically different from (0) zero correlation, one could argue for the use of a multivariate multiple regression procedure for constructing the index.

When a multiple regression procedure is used, the multiple correlation between all the supplementary variables and the core variable is computed as part of the index. The use of a multiple correlation between each supplementary variable and the core variable has the advantage of taking into account the overlap that may exist among supplementary variables in relationship to the core variables. That is, multiple correlations allow the isolation of the contribution of each supplementary variable to the prediction power of the core variable is not independent from the contribution made by other intercorrelated supplementary variables.

However, the advantage of using independent contributions to the core

variable does not seem to be very useful for practical purposes. In fact, when the results of using multiple regression procedures were compared with the results of using simple regression procedures, it was found that the percentage of target students who were assigned to each of the three performance groups; i.e., Transfer, Undecided, and No-Transfer, was very similar and showed significant differences.

The study also found that results from a prediction index constructed using a multiple regression procedure were more difficult to interpret. The instructional significance of the contribution of each supplementary variable to the prediction was lost when all these variables were clustered together into a multiple correlation. On the other hand, results from indices constructed using simple regression procedures show and maintain the instructional relevance of each one of the supplementary variables included in the index. For this reason, the instructional signficiance of the contributions made by each predictor variable can be easily determined, interpreted, and evaluated. Another reason for using simple regression is that supplementary variables differ from one school to the next, and simple regression enables schools to construct their prediction index based on their own existing data and variables.

Use of Regression Residuals

The use of regression procedures for making predictions generally results in prediction equations in which the beta weights are computed and then used to compute predicted scores. To the extent to which the predicted scores (Y') are the same or almost the same as the observed scores (Y), the predictions made using these beta weights are appropriate. The beta weights represent the

predictive power of the correlation between the supplementary and the core variable included in the index. The higher the correlation between these two variables, the more accurate the predictions, and the less the difference is between predicted and observed scores on the core variable. Thus, if the correlation between supplementary and core variables is perfect (i.e., equal to 1.00), then the difference between predicted and observed scores on the core variable is equal to zero; (Y-Y'=0). The difference between the predicted score on the core variable (Y') and the observed score on the core variable (Y) is called a regression residual, (R=Y-Y').

It was mentioned above that the correlation was an indicator of the "amount" of information included in the student's score in the core variable which can be predicted from the supplementary variable. More specifically, if the correlation between a core and a supplementary variable is equal to (+.40), one could predict, from the supplementary variable in this correlation, 16% of the variation of the core variable. However, the rest of the score (84%) cannot be predicted from such a correlation.

As a result, there are differences between the predicted scores (Y') and the observed scores (Y), differences which are not accounted for in the correlation between the core and supplementary variables. That is to say, predictions made using such a correlation will tend to produce either positive residuals (+R) or negative residuals (-R). For some of the students, however, these predictions will be accurate, and to this extent, they produce residuals equal to zero (R=0).

Thus, a regression residual (R) is a useful indicator of the amount of information in a score on the core variable which is not known on the basis of the correlation between the core and the supplementary variables.

One could interpret positive residuals (+R) as being indicators of under-prediction since the predicted score on the core variable (Y) is lower than the observed score (Y') on the core variable; zero residuals can be indicators of accurate predictions since the predicted score is equal to the observed score; and negative (-R) can be indicators of over-prediction since the predicted score is higher than the observed score. The relationships between positive residuals, zero residuals and negative residuals and errors on predictions are shown graphically in Figure 1 below.

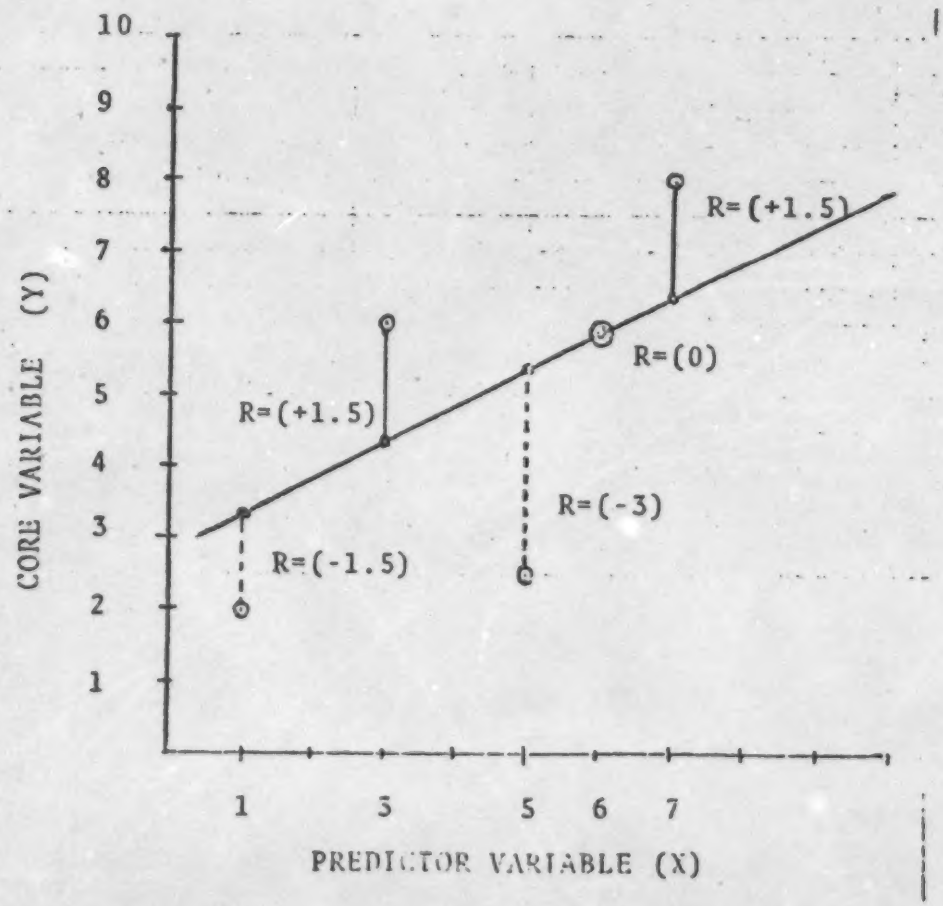
This Figure presents hypothetical data on the supplementary variable (X) and on the core variable (Y) obtained by five hypothetical children. It also shows predicted scores (Y') on the core variable based on the regression line (see dots placed on the regression line), and the resulting positive, zero, and negative residuals.

In the graph, the black dots represent predicted scores (Y') (notice that these black dots are always placed on the regression line); the white dots represent observed scores (Y); the vertical solid lines represent positive residuals (+R) (notice that these solid lines are always placed above the regression line); and the broken lines represent negative residuals (-R), (notice that these broken lines are always placed below the regression line). The value of the residuals is also included in Figure 1. The two positive residuals indicate that student numbers 002 and 003 are achieving higher scores on the core variable than predicted for all the students who have obtained either a score equal to 3 or equal to 7 on the Supplementary variable respectively. Specifically, positive residuals (+R) can be interpreted to be signs of higher school performance. The two negative residuals

FIGURE 1

Illustration of the use of regression residuals in the construction of prediction indices. (Imaginary data).

| Child's Code | Predictor Variable Score (X) Observed | Core Score (Y) Observed | Variable Score (Y') Predicted | Residual |
|---|---|---|---|---|
| 001 | 5 | 2.5 | 5.5 | -3.0 |
| 002 | 7 | 8.0 | 6.5 | +1.5 |
| 003 | 3 | 6.0 | 4.5 | +1.5 |
| 004 | 1 | 2.0 | 3.5 | -1.5 |
| 005 | 6 | 6.0 | 6.0 | 0.0 |



indicate that students 001 and 006 are achieving lower scores on the core variable than those that were predicted for all the students who have obtained a score equal to 1 and 5 on the supplementary variable respectively. Negative residuals (R-) can be interpreted to be signs of lower school performance. Finally, the zero residual indicates that student 005 is achieving as predicted for all students that have obtained a score of 6 on the Supplementary variable.

## CHAPTER THREE

## VALIDATION OF PREDICTION INDICES

There are at least three models that can be used for validating the usefulness of prediction indices. These models are: a correlation analysis that compares a prediction based on the core variable to a prediction which is based on the index; an analysis of variance model (ANOVA) that compares the average performance of four groups of students in a (2x2) factorial design; and a trait-treatment analysis (TTI) that compares the regression lines on a post-test performance on the core variable. Each one of these three models is briefly described below.

### Correlation Model

The validity of the prediction made by the indices could be assessed by finding out whether using only the core variable to assign students to Transfer or No-Transfer groups gives better results than using both the information from the core variable and the information provided by the supplementary variables through the use of regression residuals.

This kind of validation answers the following question: Is the core variable a better predictor than a combination of the core variable and various supplementary variables? This type of validation is important because the procedures for making decisions about reclassification of students in bilingual programs, seem to recommend only the use of a core variable (e.g., reading in English).

For example, K. Archuleta and R. A. Cervantes in the Bilingual Classification Criteria Report (August, 1979) recommend the use of a local district norm based on the performance of "non-minority native-English speakers" on

approved tests of language arts, reading, and computation as part of the criteria for reclassification of students attending bilingual programs. They seem to indicate that pupils who obtain "a score of not less than the thirty-sixth (36th) percentile" could be reclassified.

Given the context of the prediction indices included in this report, that recommendation might mean that those students whose score on the core variable is below one standard deviation (36 percentile) are ready to profit from instruction given solely in English, and that they could be placed in the Transfer group.

The prediction rules used for the construction of the indices are more conservative than the level of performance suggested by the above mentioned criteria. In fact, the prediction rules for the indices indicate that students who are performing between one standard deviation above (+1) and one standard deviation below (-1) the mean obtained by native-English speakers in the local district, are children for whom more information is needed. According to the prediction index, these students are placed in the "undecided" group.

To use the correlation model for validation of the prediction index, one needs to compare two correlations: One of these correlations is a simple correlation; the other is a multiple correlation. For example, the simple correlation could be computed using scores on the core variable obtained by students in the 1976 Pilot or 1977 Extended Sample Study and scores obtained by the same students one or two years later on a criterion variable, e.g., an English test in reading or math. Such tests are commonly used by the schools to assess student progress. The multiple correlation could be computed using

the scores obtained by these students on the core and supplementary variables included in an index and their scores on the criterion measure.

If the simple correlation is significantly greater than the multiple correlation, one could conclude that the core variable by itself is a better predictor. If the two correlations are not statistically significant, one could conclude that the core variable by itself is as good a predictor as the complete index that includes the core variable and various supplementary variables. Finally, if the multiple correlation is greater than the simple correlation, one could conclude that the index is a better predictor than the core variable by itself.

Factorial ANOVA Model

A factorial design that includes four groups of students (2x2 factorial) is used in applying the ANOVA model for the validation of prediction indices. The first factor in this design is based on the prediction made by the index which assigned students to either the Transfer or the No-Transfer group. The second factor is the program in which these students were placed after one or more school years. For example, some students in the 1975/76 Pilot Study were placed in monolingual English programs in the 1977/78 school year, while other students continued in the bilingual program. According to this factor, the students are clustered in either bilingual programs (maintenance/transitional) or in a monolingual English program. This design is presented in Figure 2 below.

FIGURE 2

Example of Factorial Design (2X2) which could be used for the Validation of Prediction Indices using the ANOVA Model

| PREDICTIONS MADE BY THE INDEX | EDUCATIONAL PROGRAMS | |
|---|---|---|
| | ENGLISH MONOLINGUAL | BILINGUAL |
| TRANSFER | (1) | (2) |
| NO-TRANSFER | (3) | (4) |

The application of the ANOVA model to the validation of prediction indices involves a comparison of the average performance of these four groups of students on a criterion variable which is educationally relevant for defining successful achievement. This criterion variable could be the students' post-test scores collected after one year of being in either one of these two educational programs. Thus, for example, the 1977 or 1978 post-test English reading scores obtained by students who participated in the 1975/76 Pilot Study could be used as a criterion variable for this validation.

When using the ANOVA model, the critical comparison for the validation of prediction indices is that of the average performance of those students who were ready to profit from instruction given solely in English, and who were placed in monolingual English programs, with the average performance of students who were not ready to profit from instruction given solely in English (according to the index), and yet were transferred into monolingual English programs. That is to say, the critical comparison in this design is Transfer/

English program vs. No-Transfer/English program.

This critical comparison tests the null hypothesis that students who were placed in a program and were predicted to be ready to profit from instruction in English, show an average performance equal to that obtained by students who were also placed in monolingual English programs but who were predicted not to be ready to profit from instruction given in English.

Even though the staff of the Bilingual Prediction Study has made several attempts to collect longitudinal data regarding the performance of participating students during the years following the Pilot and Extended Sample Studies, sufficient data to use in the ANOVA model for validation of the prediction indices are not yet available. This is because the longitudinal data that the staff of the Bilingual Prediction Study was able to collect consisted of samples of students too small to validate the application of the model. It is recommended that the collection of longitudinal data for students in the original sample be continued.

## The Trait-Treatment Analysis Model

The Trait-Treatment Interaction model (TTI) was recommended as a highly useful model for the analysis of placement tests. This model could be used to assess whether the instructional program in which a student was previously placed is better than an alternative instructional program in which the student was subsequently placed.

Three steps are included in the application of the TTI model for the validation of placement tests. In describing the usefulness of the TTI model for the validation of prediction indices, these three steps are summarized as follows:

First, a test of the significance of the possible differences between residual variances of the distributions of scores on the core variable should be made.

Second, if the difference between these residual variances is not statistically significant, test for the differences between the regression slopes of the scores obtained by the students in the bilingual and the students in the English monolingual programs.

Third, the two regression slopes should be studied to see whether or not they show the existence of a disordinal interaction, and to determine the point of intersection of the two regression lines.

A design used to apply the TTI model consists of two groups of students. (Refer to Figure 3.) The first group includes all the students that were placed in the transfer group according to the index and who were also transferred to English monolingual programs. The second group includes those students that were also placed in the transfer group according to the index but who were kept in bilingual programs.*

The use of the TTI model for validating prediction indices requires longitudinal data on an acceptable criterion measure, data obtained by the students in these two groups. For example, one could use the CTBS/S English reading test scores obtained in Spring, 1976 and Spring, 1977 from the students in the Pilot Study that were placed in the transfer group.

The TTI model will compare the regression lines of these two groups of students. The TTI model compares the students' scores on the core variable,

*Some of the students who participated in the Bilingual Prediction Study were transferred into monolingual English programs following the specific criteria established in their schools. At that time, the Bilingual Prediction Study had not yet produced prediction indices that these schools could use to aid in making transfer decisions.

obtained in Spring, 1976 and/or Spring, 1977 from the Pilot and Extended Study and that of the Extended Sample Study would have to be divided into two groups of students. Because of the mobility of these student populations, the available longitudinal data would be too small. At present time, there is not enough longitudinal data available to use the TTI model. However, it is suggested that the efforts for collecting such information from school records be continued.

FIGURE 3

Design that could be used for the validation of prediction indices using the Trait-Treatment Analysis Model (TTI).

| PREDICTION GROUPS | EDUCATIONAL PROGRAMS | |
|---|---|---|
| | ENGLISH MONOLINGUAL | BILINGUAL |
| TRANSFER | (1) | (2) |

# CHAPTER FOUR

## LIMITATIONS ON THE USE OF PREDICTION INDICES

The Bilingual Prediction Study has provided information about the relationships between a set of core and supplementary variables as well as a procedure to enable school districts to construct indices. These indices are useful statistical tools for facilitating decisions regarding a child's readiness to profit from instruction in the English language.

These indices, like any "tool", should be used with caution. Prediction indices included in the Manual and in this Final Report have two kinds of limitations: those that refer to the procedure used for constructing prediction indices; and those that address the use of prediction indices. In the User's Manual, only limitations regarding the use of prediction indices are included.

Described below are the limitations of the use of prediction indices which the user must bear in mind when deciding whether to use the procedure included in the manual. They refer to the interpretation of the predictions resulting from the indices the implicit assumptions which stem from the selection of either core of supplementary variables, the selection of the instruments to measure core and supplementary variables and the assignment of students to prediction groups. Each one of these four types of limitations is briefly described below.

### Interpretation

Results obtained using a specific indices are useful for making decisions regarding the students for whom the indices were constructed. Thus, the results obtained from an index (such as, correlation coefficients, estimators

of beta parameters, regression residuals, etc.) are not to be generalized to any other population of students. For example, the results of an index cannot be generalized from students in one grade to students in different grades. This limitation applies even when the two groups of students are from the same school district. The indices should be used for specific students attending a specific grade within an educational program in a particular school district. The results are valid only for the population included in the index.

An index must be used with the specific population for which the predictions are made. One could hypothesize that two bilingual programs have the same or very similar goals, objectives, educational approaches, and assessment instruments. Yet, it is possible that the environment of two school districts differ significantly, thereby rendering the index developed for one district inappropriate for the other. Also, use of an index for different student populations enrolled in different educational programs within the same school or district is not recommended.

A prediction index cannot be used to indicate whether an educational program, bilingual or monolingual, is the best instructional setting for a student. It can be used to predict, with reasonable accuracy, whether the student is likely to be ready, and has a good chance of succeeding, in the instructional environment for which the index was constructed.

## Assumptions

Prediction indices are not to be used as theoretical constructs. They were not designed to provide a theoretical framework for determining cause-effect relationships between variables and outcomes. Although the procedure involves the use and examination of the correlation between supplementary and

core variables, this, in and of itself, does not prove a cause-effect relation between the two variables.

For example, one cannot say that because the index indicates that 60% of the children in the target population are ready to profit from instruction provided in English, and because the index uses Spanish reading as a supplementary variable that there is a cause-effect relationship between Spanish reading and English reading. In fact, the correlation between English and Spanish reading tends to vary from one population of students to another. It also seems to be related to the amount of reading instruction in Spanish and English provided in the school.

Consequently, users of prediction indices should NOT rely solely on one prediction index to make decisions regarding the future of target students. An index is designed to predict a single and specific school outcome. Each one of these outcomes is only a partial indicator of the student's readiness to profit from instruction when a major educational change in the mode of instruction is made.

Core and supplementary variables must be selected by a panel of educators who are very familiar with the following three factors: the characteristics of the target population; the curriculum taught in both the bilingual and the regular English monolingual programs; and the instructional requirements in the classrooms to which the target children may be transferred. The school district should take all of the steps necessary to insure that a decision based on a prediction is equitable.

The evaluator and/or administrator, who analyzed the residuals and who decides the ultimate grouping of the students, should seriously consider the

contribution of the residuals both separately and as a whole. As the previous section explains, the contributions of the residuals in an index may overlap. Both the degree of correlation between the supplementary variables and the nature of the area measured may influence the accuracy of a Prediction. Thus the student's profile should be examined and interpreted according to the instructional relevance of each variable. This will insure a fair and accurate prediction.

There are various assumptions made when selecting the core variables of a prediction index. Those assumptions are taken into account by the rules for selecting core variables. These rules have been presented in previous sections; thus, they are mentioned here only briefly.

The first assumption is that the variable selected as a core variable is a good predictor of achievement each being necessary for success in the new instructional environment. Since there is no variable that can be in and of itself a good predictor for all of those requirements, it seems necessary to construct several indices, each designed to make predictions for one of three requirements. It is recommended that some of these prediction indices include a core variable that is a good predictor of achievement. For example, English reading is likely to be a good predictor of achievement in social studies when taught in English. Other indices could include a core variable which seems to be a good predictor of performance in school (e.g., classroom participation) or of adaptation to the new instructional environment.

The prediction indices included in the manual and discussed in the Final Report of the Bilingual Prediction Study are examples of indices to predict achievement. They show an application of the procedure for the construction

of indices. Prediction indices which could be used to predict school performance and/or school adaptation are not included.

Instruments

The contribution of a variable to an index may fluctuate according to such factors as the type of assessment instrument, the time of testing. The usefulness of an index will increase or decrease in direct relation to the reliability and validity of the instrument used to measure the variables. Therefore, instruments of recognized psychometric properties should be used. Before reaching a decision to use a prediction index, a panel of educators should decide whether the assignment of students to prediction groups is an appropriate strategy to facilitate learning and improve student performance in school.

Assignment

The grouping assignments that result from the application of prediction indices is not to be used as a "tracking" system. The group assignments should be validated, modified and adapted every school year after each reclassification of language proficiency. Prediction indices are not intended to place students permanently in a particular mode of instruction. On the contrary, their purpose is to facilitate decisions about readiness for educational changes which are supposed to benefit the student and increase student learning opportunities.

Limitations on the Construction of the Indices

The first problem discussed previously, is the sample size for which these indices will be created. When the number of cases is small, the corre-

lation and the regression coefficient are unstable. Consequently, it is suggested that district use grade levels (or several classrooms) when constructing prediction indices.

The second concern is the reliability of the instruments used to assess supplementary and core variables. The reliability of the scores is always open to question. Schools would pay considerable attention to this matter when selecting the assessment instruments.

The selection of core and supplementary variables is also of great concern. This would depend on establishing which factors are important for success in the new instructional setting and which of the supplementary variable has a logical and significant relationship to the core variable.

The selection of the norm and/or comparison groups is also important. If a student transfers from one instructional setting to another, then it is important to determine the characteristics of the new instructional setting. Among these is the level of performance required of the potential peer group of the student in question.

Finally the correlation between supplementary variables should be carefully considered in order to avoid misclassification of students. As was previously indicated, the instructional relevance of these variables should be weighed as heavily as their statistical significance to the core variable.

# BIBLIOGRAPHY


Archuleta, Katherine; Cervantes, Robert A. Bilingual reclassification criteria report. State Bilingual Reclassification Committee, Office of Bilingual Bicultural Education, California State Department of Education, August, 1979.

Baker, Eva L. Evaluation of the California early childhood education program. Evaluation of the Early Childhood Education Program I, Center for the Study of Evaluation, University of California, Los Angeles, December, 1976.

Cerriantes, R., & Bernal, H. H. Psychosocial growth and academic achievement in Mexican-American students. Development Associates, Management and Government Consultants, San Antonio, Texas.

De Avila, Edward A., Cervantes, Robert A. Bilingual program exit criteria. De Avilla, Duncan & Associates, Inc., Larkspur, CA, May, 1978.

Gardner, R. C. "Attitude and motivation: Their role in second language acquisition." TESOL Quarterly, 2, 1968.

Lambert, & Gardner, K. R. Attitudes and motivation in second language learning. Rowley, Mass: Newbury House, 1972.

Lambert, W. E., Gardner, R. C., Barik, H. C., & Tunstall K. "Attitudinal and cognitive aspect of intensive study of a second language." Journal of Abnormal and Social Psychology, 1963, 66(4), 358-368.

Lambert, W. E., Havelka, J., & Crosby, C. "The influence of language acquisition context on bilingualism." Journal of Abnormal and Social Psychology, 1958, 56, 239-244.

Supreme Court of the U.S., Washington, D. C. (BBB06371). Supreme Court of the United States, Lau et al., v. Nichols et al., January, 1974.

United States District Court, Eastern District of New York (77-C-1370) Elis Cintron, et al. v. Brentwood Union Free School District, January, 1978.